

# Fire Flow Requirements for Buildings

## ANNEX H

*This annex is not a part of the requirements of this NFPA document unless specifically adopted by the jurisdiction.*

### H.1 Scope

The procedure determining fire flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with Annex H. Annex H does not apply to structures other than buildings.

Annex H gives the AHJ one option of calculating required fire flow as specified in paragraph 18.3.1.

### H.2 Definitions

For the purpose of Annex H, certain terms are defined as follows.

#### H.2.1 Fire Area.

The floor area, in square feet, used to determine the required fire flow.

Fire area should be determined based on the area within the surrounding exterior walls and 4-hour fire walls, exclusive of courts. Areas of the building without surrounding exterior walls should be included in the fire area if such areas are within the horizontal projection of the roof or floor above.

#### H.2.2 Fire Flow.

The flow rate of a water supply, measured at 20 psi (137.9 kPa) residual pressure, that is available for fire fighting.

### H.3 Modifications

#### H.3.1 Decreases.

Fire flow requirements may be modified downward by the AHJ for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire flow requirements is impractical.

#### H.3.2 Increases.

Fire flow shall be permitted to be modified upward by the AHJ where conditions indicate an unusual susceptibility to

group fires or conflagrations. An upward modification shall not be more than twice that required for the building under consideration.

### H.4 Fire Area

**H.4.1 General.** The fire area shall be the total floor area of all floor levels except as modified in Section H.4.

The fire area should be determined based on the area within the surrounding exterior walls, and 4-hour fire walls, exclusive of courts. Areas of the building without surrounding exterior walls should be included in the fire area if such areas are within the horizontal projection of the roof or floor above. The fire area includes the total of all floor areas except as listed in paragraph H.4.3.

#### H.4.2 Area Separation.

Portions of buildings that are separated by one or more 4-hour fire wall constructed in accordance with the building code, without openings and provided with a 30 in. (76 cm) parapet, are allowed to be considered as separate fire areas.

#### H.4.3 Type I (443), Type I (332), and Type II (222) Construction.

The fire area of buildings constructed of Type I (443), Type I (332), and Type II (222) construction shall be the area of the three largest successive floors.

Due to the inherent fire resistance, the fire area of buildings with Type I (443), Type I (332), and Type II (222) construction is limited to the three largest successive floors.

### H.5 Fire Flow Requirements for Buildings

#### H.5.1 One- and Two-Family Dwellings.

The minimum fire flow and flow duration requirements for one- and two-family dwellings having a fire area that does not exceed 3600 ft<sup>2</sup> (334.5 m<sup>2</sup>) shall be 1000 gpm (3785 L/min). Fire flow and flow duration for dwellings having a fire area in excess of 3600 ft<sup>2</sup> (334.5 m<sup>2</sup>) shall not be less than that specified in Table H.5.1.

TABLE H.5.1 Minimum Required Fire Flow and Flow Duration for Buildings

Fire Area ft <sup>2</sup> (× 0.0929 for m <sup>2</sup> )					Fire Flow gpm <sup>2</sup> (× 3.785 for L/min)	Flow Duration (hours)
I(443), I(332), II(222) <sup>1</sup>	IV(111), III(211) <sup>1</sup>	IV(2HH), III(111) <sup>1</sup>	II(000), III(200), III(000) <sup>1</sup>	V(000) <sup>1</sup>		
0–22,700	0–12,700	0–8,200	0–5,900	0–3,600	1,500	2
22,701–30,200	12,701–17,000	8,201–10,900	5,901–7,900	3,601–4,800	1,750	
30,201–38,700	17,001–21,800	10,901–12,900	7,901–9,800	4,801–6,200	2,000	
38,701–48,300	21,801–24,200	12,901–17,400	9,801–12,600	6,201–7,700	2,250	
48,301–59,000	24,201–33,200	17,401–21,300	12,601–15,400	7,701–9,400	2,500	
59,001–70,900	33,201–39,700	21,301–25,500	15,401–18,400	9,401–11,300	2,750	3
70,901–83,700	39,701–47,100	25,501–30,100	18,401–21,800	11,301–13,400	3,000	
83,701–97,700	47,101–54,900	30,101–35,200	21,801–25,900	13,401–15,600	3,250	
97,701–112,700	54,901–63,400	35,201–40,600	25,901–29,300	15,601–18,000	3,500	
112,701–128,700	63,401–72,400	40,601–46,400	29,301–33,500	18,001–20,600	3,750	
128,701–145,900	72,401–82,100	46,401–52,500	33,501–37,900	20,601–23,300	4,000	4
145,901–164,200	82,101–92,400	52,501–59,100	37,901–42,700	23,301–26,300	4,250	
164,201–183,400	92,401–103,100	59,101–66,000	42,701–47,700	26,301–29,300	4,500	
183,401–203,700	103,101–114,600	66,001–73,300	47,701–53,000	29,301–32,600	4,750	
203,701–225,200	114,601–126,700	73,301–81,100	53,001–58,600	32,601–36,000	5,000	
225,201–247,700	126,701–139,400	81,101–89,200	58,601–65,400	36,001–39,600	5,250	
247,701–271,200	139,401–152,600	89,201–97,700	65,401–70,600	39,601–43,400	5,500	
271,201–295,900	152,601–166,500	97,701–106,500	70,601–77,000	43,401–47,400	5,750	
295,901–Greater	166,501–Greater	106,501–115,800	77,001–83,700	47,401–51,500	6,000	
295,901–Greater	166,501–Greater	115,801–125,500	83,701–90,600	51,501–55,700	6,250	
295,901–Greater	166,501–Greater	125,501–135,500	90,601–97,900	55,701–60,200	6,500	
295,901–Greater	166,501–Greater	135,501–145,800	97,901–106,800	60,201–64,800	6,750	
295,901–Greater	166,501–Greater	145,801–156,700	106,801–113,200	64,801–69,600	7,000	
295,901–Greater	166,501–Greater	156,701–167,900	113,201–121,300	69,601–74,600	7,250	
295,901–Greater	166,501–Greater	167,901–179,400	121,301–129,600	74,601–79,800	7,500	
295,901–Greater	166,501–Greater	179,401–191,400	129,601–138,300	79,801–85,100	7,750	
295,901–Greater	166,501–Greater	191,401–Greater	128,301–Greater	85,101–Greater	8,000	

<sup>1</sup> Type of construction are based on NFPA 220.<sup>2</sup> Measured at 20 psi (139.9 kPa).

The fire flow requirements in Table H.5.1 are based on buildings without fire sprinkler protection. Buildings with fire sprinkler protection and installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*; NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*; and NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, should receive a fire sprinkler credit to the required fire flow from Table H.5.1. See the text and commentary in paragraphs H.5.1 and H.5.2 for the appropriate fire flow credit for buildings protected by fire sprinkler systems.

*Exception: A reduction in required fire flow of 50 percent, as approved, shall be permitted when the building is provided with an approved automatic sprinkler system.*

The fire flow calculation recognizes the significant benefits of fire sprinkler protection in a one- and two-family dwelling by providing a 50 percent credit for the fire flow (see the exception to paragraph H.5.1). A single-family dwelling that is less than 3600 ft<sup>2</sup> (334.5 m<sup>2</sup>) and protected by a fire sprinkler system in accordance with NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, would have a required fire flow of 500 gpm (1892.5 L/min) rather than 1000 gpm (3785 L/min). *min w/ 5/5*

## H.5.2 Buildings Other than One- and Two-Family Dwellings.

The minimum fire flow and flow duration for buildings other than one- and two-family dwellings shall be as specified in Table H.5.1.

*Exception: A reduction in required fire flow of up to 75 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system. The resulting fire flow shall not be less than 1000 gal per minute (3785 L/min). min*

The following example illustrates the reduction in fire flow for a sprinklered building.

### EXAMPLE

A nonsprinklered building with a calculated 3500 gpm (13,250 L/min) required fire flow would be allowed a

reduced fire flow of 1000 gpm (3785 L/min) if it were protected by a sprinkler system in accordance with NFPA 13.

### Solution

$3500 \text{ gpm (13,250 L/min)} \times 75\% = 2625 \text{ gpm (9935.6 L/min)}$  (fire flow credit)

$3500 \text{ gpm (13,250 L/min)} - 2625 \text{ gpm (9940 L/min)}$  (fire flow credit) = 875 gpm (3312 L/min) (fire flow)

The calculated fire flow of 875 gpm (3312 L/min) is less than 1000 gpm (3785 L/min), the minimum permitted by paragraph H.5.2

In most circumstances, the AHJ should allow for the maximum credit to be applied. However, in a small number of circumstances, the fire flow required by Annex H might be less than the water supply required by NFPA 13 for the fire sprinkler system design. In these cases, the minimum water supply required by NFPA 13 needs to be provided.

## REFERENCES

### Commentary References

- NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2002 edition.
- NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2002 edition.
- NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, 2002 edition.

# Fire Hydrant Locations and Distribution

## ANNEX I

*This annex is not a part of the requirements of this NFPA document unless specifically adopted by the jurisdiction.*

To be usable, fire hydrants must be reasonably accessible to the fire department, in accordance with Section I.2. Hydrants placed in areas without access along a fire apparatus road or public street would be difficult to locate, access, and use.

### I.1 Scope

Fire hydrants shall be provided in accordance with Annex J for the protection of buildings, or portions of buildings, hereafter constructed.

### I.2 Location

Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets.

### I.3 Number of Fire Hydrants

The minimum number of fire hydrants available to a building shall not be less than that listed in Table I.3. The number of fire hydrants available to a complex or subdivision shall not be less than that determined by spacing requirements listed in Table I.3 when applied to fire apparatus access roads and perimeter public streets from which fire operations could be conducted.

**TABLE I.3** *Number and Distribution of Fire Hydrants*

<i>Fire Flow Requirements (gpm)</i>	<i>Number and Distribution of Fire Hydrants</i>		<i>Maximum Distance from any Point on Street or Road Frontage to a Hydrant<sup>4</sup> (ft)</i>
	<i>Minimum Number of Hydrants</i>	<i>Average Spacing Between Hydrants<sup>1,2,3</sup> (ft)</i>	
1750 or less	1	500	250
2000–2250	2	450	225
2500	3	450	225
3000	3	400	225
3500–4000	4	350	210
4500–5000	5	300	180
5500	6	300	180
6000	6	250	150
6500–7000	7	250	150
7500 or more	8 or more <sup>5</sup>	200	120

Note: 1 gpm = 3.8 L/min; 1 ft = 0.3 m.

<sup>1</sup> Reduce by 100 ft (30.5 m) for dead-end streets or roads.

<sup>2</sup> Where street are provided with median dividers which can be crossed by fire fighters pulling hose lines, or arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 ft (152.4 m) on each side of the street and be arranged on an alternating basis up to a fire flow requirement of 7000 gpm (26,500 L/min) and 400 ft (122 m) or higher fire flow requirements.

<sup>3</sup> Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1000 ft (305 m) to provide for transportation hazards.

<sup>4</sup> Reduce by 50 ft (15.2 m) for dead-end streets or roads.

<sup>5</sup> One hydrant for each 1000 gpm (3785 L/min) or fraction thereof.

Section I.3 and Table I.3 do not require hydrants to be within a minimum distance of the building. The minimum distance to the building is established by the fire department access road design location specifications in paragraphs 18.2.2.2 and 18.2.2.3. Once the location of the fire department access road is determined, Table I.3 is applied to distribute hydrants along the fire department access road.

The fire flow requirement column in Table I.3 is the required fire flow from Annex H or other referenced documents. The fire flow requirement should take into account all appropriate fire flow credits or increases.

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#### **I.4 Consideration of Existing Fire Hydrants**

Existing fire hydrants on public streets are allowed to be considered as available. Existing fire hydrants on adjacent properties shall not be considered available unless fire apparatus access roads extend between properties and easements are established to prevent obstruction of such roads.

Section I.4 allows existing hydrants to be considered if access to the existing hydrants can be provided along a fire

department access road. If existing hydrants on an adjacent property are to be considered as part of the minimum required number of fire hydrants, a cross-access easement and maintenance agreement should be executed between the property owners and the AHJ. These agreements ensure long-term unobstructed access and maintenance of the private fire hydrants for both properties.

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#### **I.5 Distribution of Fire Hydrants**

The average spacing between fire hydrants shall not exceed that listed in Table I.3.

*Exception: The AHJ shall be permitted to accept a deficiency of up to 10 percent where existing fire hydrants provide all or a portion of the required fire hydrant service. Regardless of the average spacing, fire hydrants shall be located such that all points on streets and access roads adjacent to a building are within the distances listed in Table I.3.*